

PROMUS OUTLOOK-GRANGER PROJECT

NEW DIGESTER MODEL: RNG, RECOVERED NUTRIENTS & FIBER

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Presentation Overview

1. WA Dept. of Commerce RNG/Nutrient Recovery Feasibility Study (2012)
2. Promus Outlook-Granger Project Overview

1. WA COMMERCE RNG FEASIBILITY STUDY

- Team selected to conduct 2012 feasibility study (WSU, Promus, et al)
- Purpose
 - Evaluate DeRuyter Digester
 - RNG vs. CHP (Promus)
 - Full nutrient recovery (WSU's Craig Frear)

<http://csanr.wsu.edu/publications/deRuyterFeasibilityStudy.pdf>

Findings

1. Greater revenue potential from RNG
2. Diversified revenue stream important
3. Greater returns with greater biogas production
4. Full nutrient recovery feasible = regulatory certainty

DeRuyter Situation

Reports of excessive nitrate levels in well water.
Recently, unprecedented agreement between Washington dairy CAFOs and EPA on practices and technologies to be implemented for improved control of potential manure nutrient contaminants (US-EPA, 2013b).

Current PPA rate:
\$0.0654/kWh
Drops to:
\$0.0350/kWh



EPA-910-R-12-003 | www.epa.gov



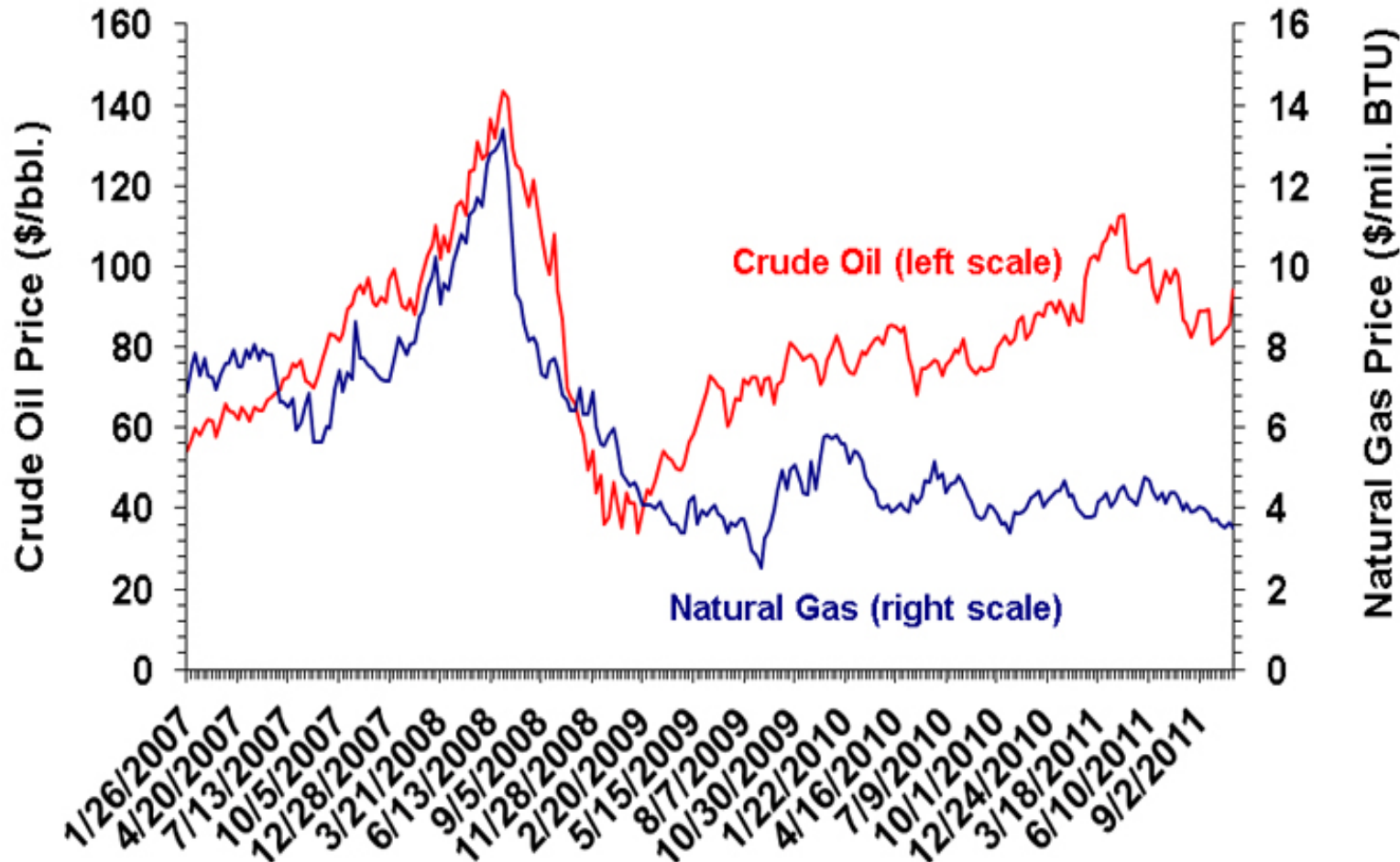
**Relation Between Nitrate
in Water Wells and Potential
Sources in the Lower Yakima
Valley, Washington**

Pacific Power Proposed Schedule 37 Tariff (2012)	
Deliveries During Calendar year	Price Per kWh
2012	\$0.0261
2013	\$0.0350
2014	\$0.0382
2015	\$0.0408
2016	\$0.0437
2017	\$0.0464
2018	\$0.0505
2019	\$0.0543
2020	\$0.0530
2021	\$0.0634

DeRuyter Dairy & Digester Overview

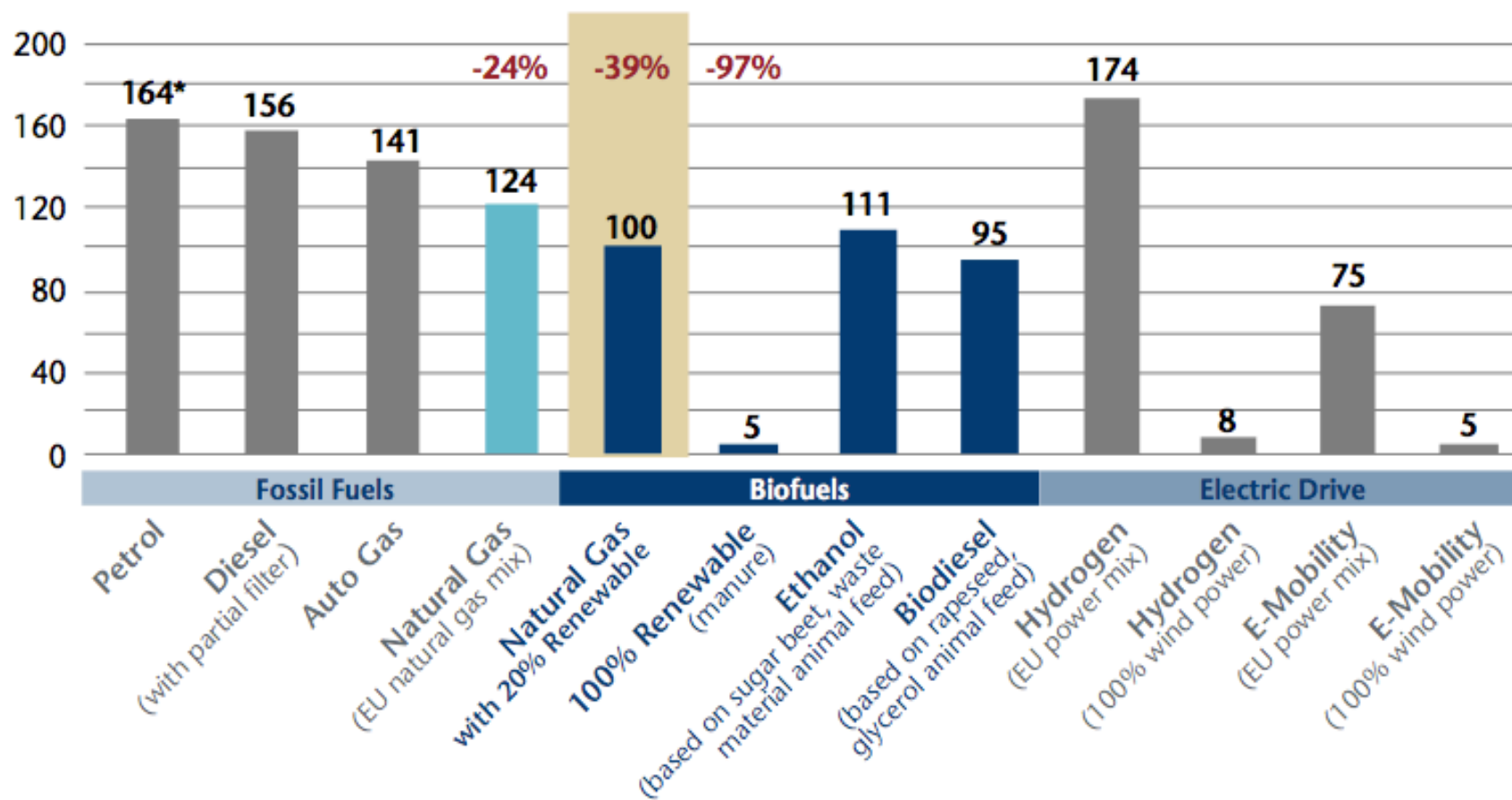
- Located west of Sunnyside in Yakima Valley
- 5,300 dairy cows
- Digester: DVO/Andgar mixed-plug flow
- 3.3 million gallon, 21 day retention time
- Influent: > 98% manure (7% solids)
- Current biogas production < 300 scfm, target for RNG 500 scfm (biogas)
- CHP: 2 600kW Guascor gen sets; average 1 MW
- 5000+ acres of croplands

Decoupling of Gas & Petroleum Pricing Since 2009



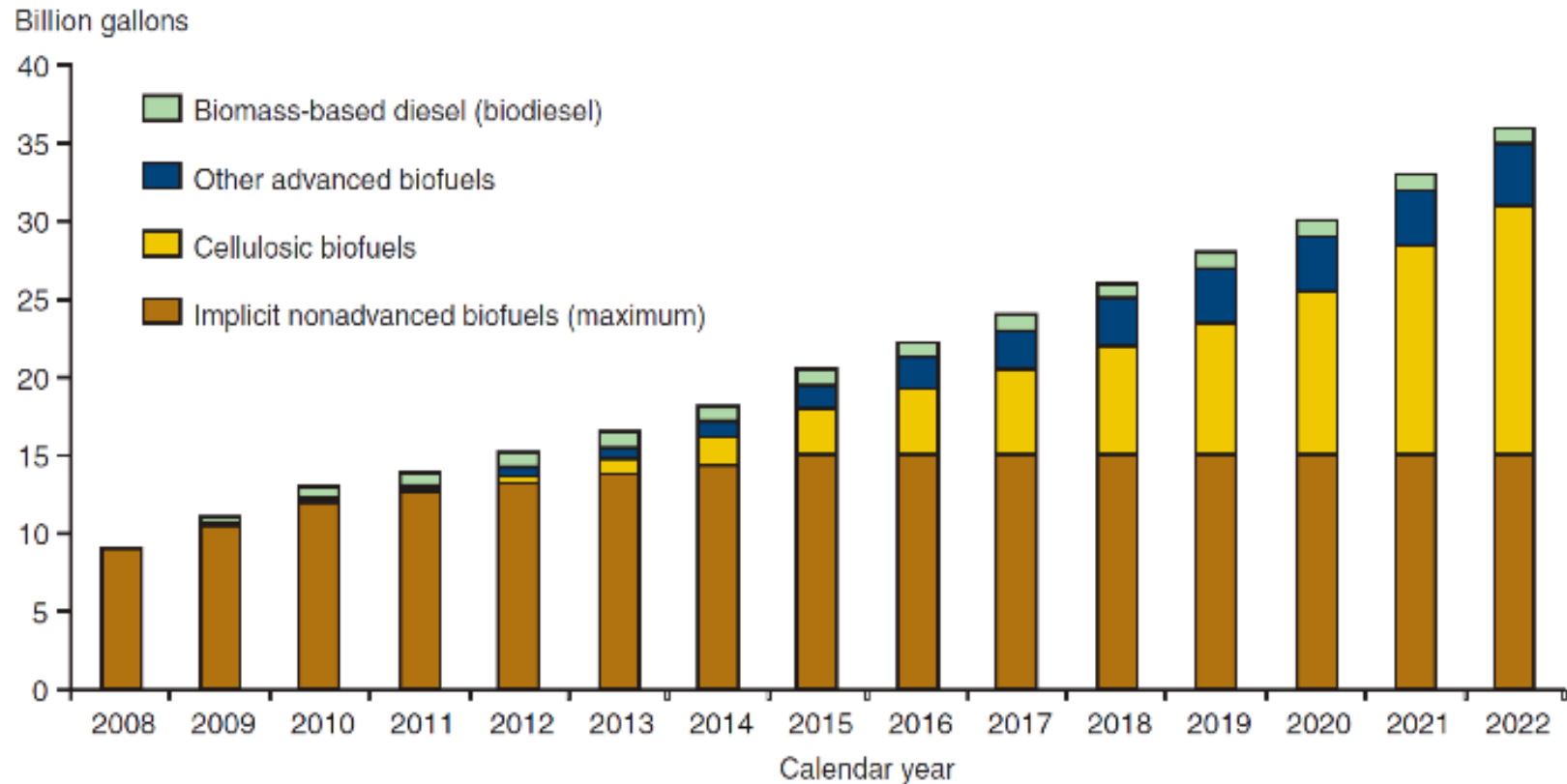
Well-to-Wheel GHG Emissions

Source: DENA -- German Energy Agency



* Reference vehicle: gasoline engine (induction engine), consumption 71 per 100 km.

RFS mandate 2008-2022 (McPhail et al, 2011)

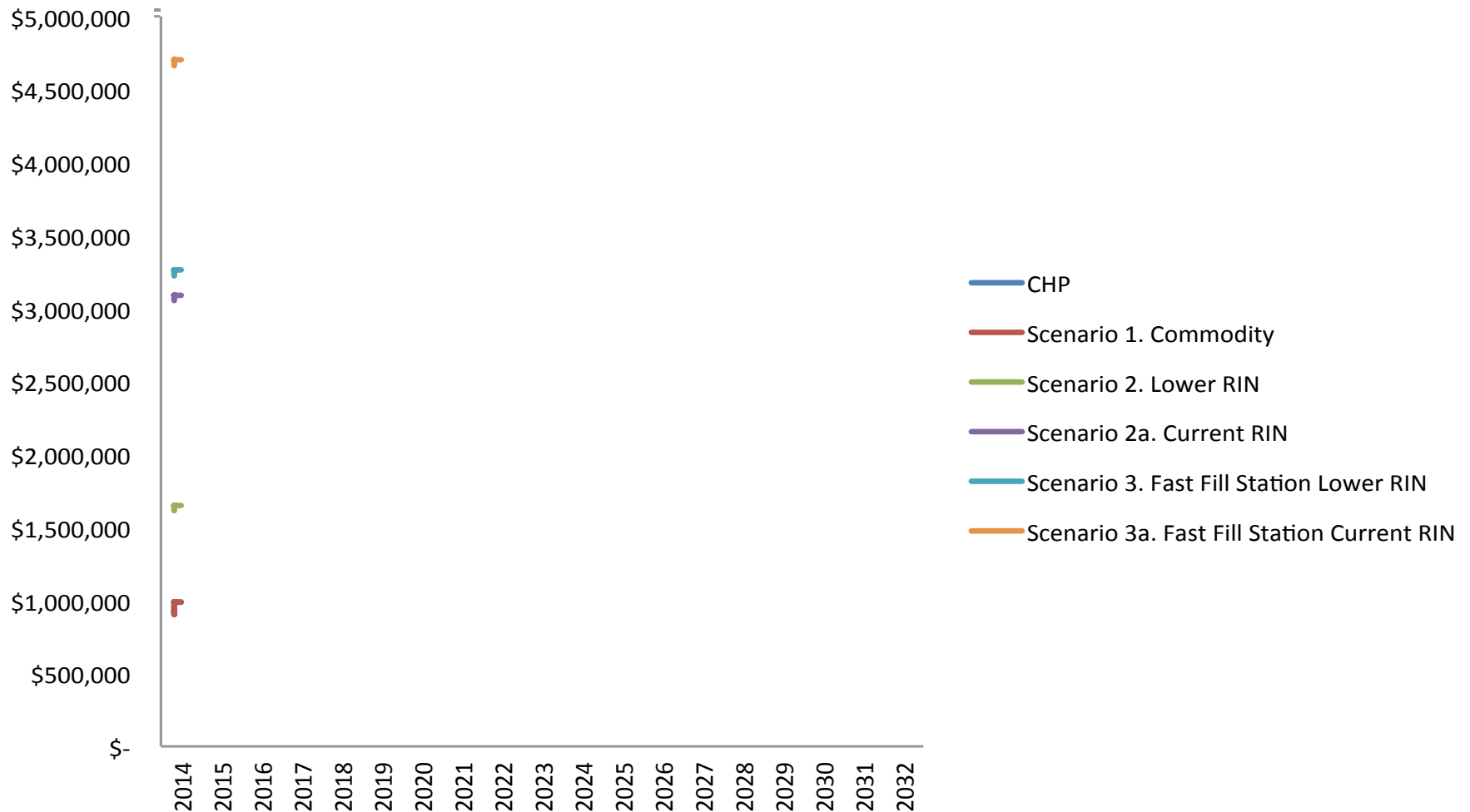


Nutrient Recovery

Emerging nutrient recovery technology (based on WSU approach) could allow for valued fiber, phosphorus-rich fine solids, and ammonium sulfate products while reducing lagoon nitrogen and phosphorus loadings by 60 and 80%, respectively—thereby offering a nutrient partitioning opportunity between lagoon water and concentrated products that could assist dairies.

Capital (50,000 gallons/day)		\$689,000	
Expenses	(\$/day)	Revenue	(\$/day)
Electricity (58 Kwh/h@ \$0.06/Kwh)	110	Ammonium Sulfate (3.1 tons @ \$120/ton)	372
Sulfuric Acid (\$200/ton)	162	P-Solids (1.6 tons @\$120/dry ton)	192
DAF Dewatering (\$0.001/gallon)	50	Based on potential wholesale value of 8:0:0:9 bio-ammonium sulfate as compared to present sales of inorganic ammonium sulfate and retail value of phosphorus content in organic solids (2:3:1 dry NPK)—retail assumed for added value of carbon/micronutrients	
O&M (labor, contingency parts)	154		
Heat (assume thermal available CHP)	---		
Storage (assume on-site storage)	---		
Transportation (assume near sales)	---		
Total	476	Total	564

NET CASH FLOW CHP AND RNG SCENARIOS



Conclusions: Good News/Challenges

Good news for RNG and digester products:

- Upside, potentially very profitable, esp. with credits (RINs, cc)
- AD-based waste-to-revenue system > multiple rev. streams
- Addresses environmental, economic, community issues
- Shift to methane transportation fuels facilitates RNG use

Challenges: risk, debt, infrastructure –

- High capital cost / debt for RNG & NR difficult for farmers
- Multiple, complex technical and business steps
- Evolving technology (nutrient recovery – phase in)
- Unreliable credit markets
- Manure collection (e.g. free stall/flush), substrate required
- Immature markets for products; difficulty in long-term agmts.

2. Promus Outlook- Granger Proj. Overview

PROMUS ENERGY

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Project Overview

Components

DeRuttyer Digester
Cow Palace Digester
Joint Gas Scrubbing
Pipeline Injection
Full Nutrient Recovery

Products

Renewable Natural Gas
Fiber
Bio-Fertilizer
Carbon Credits

Project Specifics

- Digesters
 - DeRuttyer digester + new AD at Cow Palace
 - 8,600 cows worth of manure
 - 20% organic substrate (e.g., glycerin, sugar, carbs)
- Digester Products
 - Pipeline quality RNG (7000+ DGE/day)
 - Credits (carbon (\$200k/y); RIN (\$1.94 DGE); LCFS; AFETC)
 - Value-Added Fiber as Peat
 - 190 cubic yards per day at \$11/cubic yard
 - Ammonium Sulfate Solution (8:0:0:10)
 - 15 tons per day for direct sales or blending
 - Phosphorus Solids
 - 12 dry tons per day of 3% P